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***AN ESTIMATE OF THE MIGRATORY TIMING OF SOCKEYE
SALMON INTO UPPER COOK INLET, ALASKA, IN 1991
USING A TEST FISHERY***

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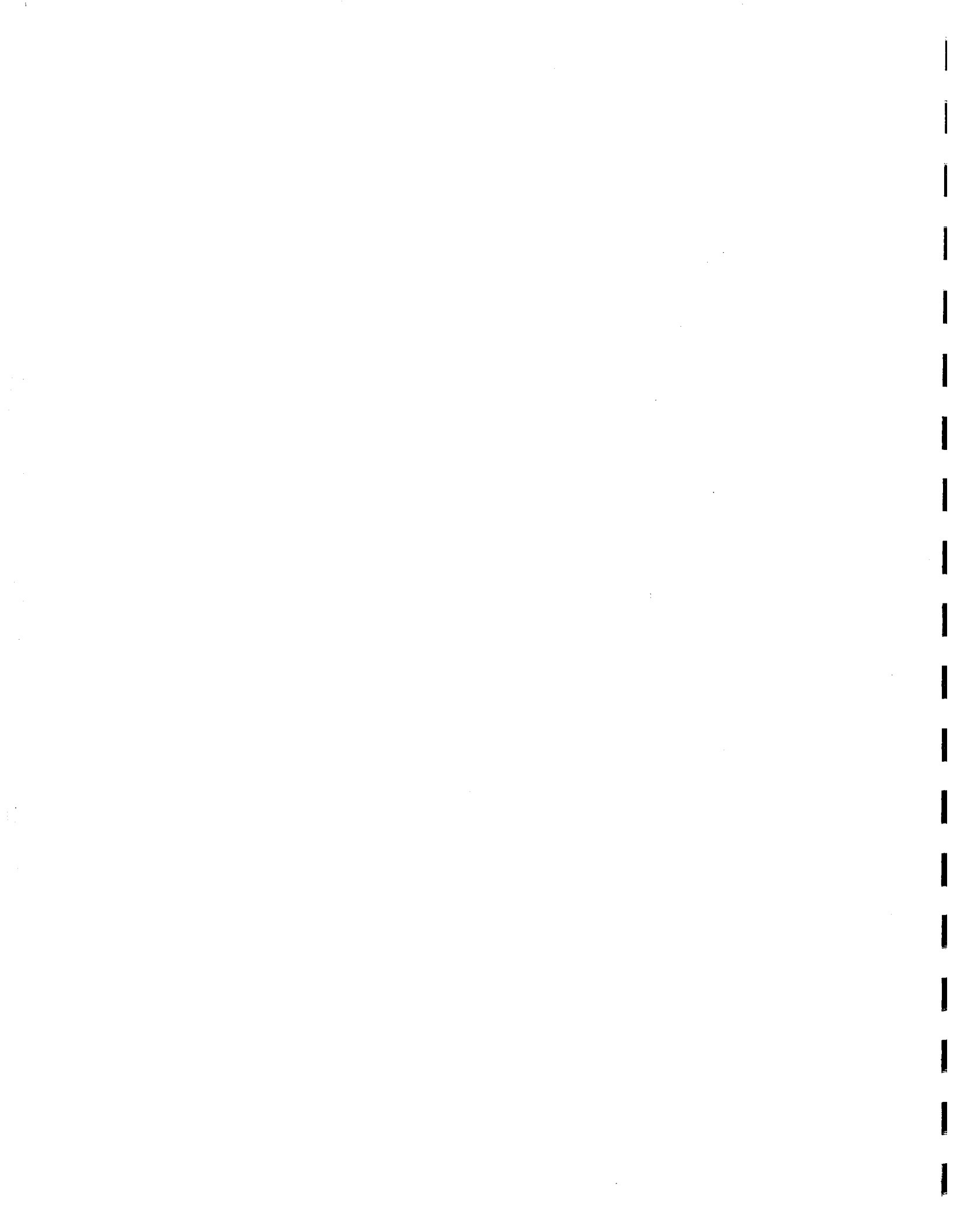
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ABSTRACT

During the 1991 Upper Cook Inlet, Alaska commercial salmon fishing season a test fishery was used to estimate the timing of the sockeye salmon, *Oncorhynchus nerka*, run as it passed a transect along the southern boundary of the management area. The test fishery operated from 1 July to 30 July and captured 2,401 sockeye salmon representing 1,574.1 CPUE points. Mean date of the run was 17 July, and the test fishery encompassed approximately 89.5% of the total run.

KEY WORDS: Salmon, *Oncorhynchus*, Upper Cook Inlet, Alaska, test fishery, migratory behavior



INTRODUCTION

In 1979, the Alaska Department of Fish and Game (ADF&G) began a test fishing project near the southern boundary of the Upper Cook Inlet (UCI) salmon management area (Figure 1). The objective of this project was to estimate the total run of sockeye salmon, *Oncorhynchus nerka*, to UCI before salmon reached commercial harvest areas. Such information has helped ADF&G management biologists set commercial fishing times and areas to harvest sockeye salmon surplus to spawning needs. Test fishing results have been reported annually since 1979 (Waltemyer 1983a, 1983b, 1986a, 1986b, Hilsinger and Waltemyer 1987, Hilsinger 1988, Tarbox and Waltemyer 1989, Tarbox, 1990). This report presents the results of the 1991 test fishing project.

METHODS

Test Fishing

Sockeye salmon returning to Upper Cook Inlet were sampled by fishing geographically fixed stations between Anchor Point and Red River Delta (Figure 1). Stations were numbered consecutively from east to west. Station locations were determined from LORAN C coordinates. A chartered test fishing vessel sampled stations 4 - 8 daily. To determine whether an increase in sampling power would improve estimates, an additional station (6a) was sampled every other day. Data for this station were not incorporated into actual estimates but were evaluated independently for this report.

Sampling started on 1 July 91 and continued through 30 July. The chartered vessel, *F/V Corrina Kay*, fished 200 fm (366 m) of 2.1 cm (5 1/8 in) multifilament gill net during test fishing. Drift gill net web had a filament size number of 53/S6F, was 45 meshes deep, and was constructed of double knot Super Crystal shade number 1.

All salmon captured were identified to species. All sockeye salmon were measured for length (mid-eye to fork of tail in mm). The number of each species caught at each station was expressed as a catch per unit of effort (CPUE) statistic:

$$CPUE_s = \frac{100 \text{ fm} \times 60 \text{ min} \times \text{number of fish}}{\text{fm of gear} \times \text{MFT}},$$

where: $CPUE_s$ = CPUE for station s , and
MFT = mean fishing time.

Mean fishing time was calculated as:

$$\text{MFT} = (C - B) + \frac{[B - A] + [D - C]}{2},$$

where: A = time net deployment started,
B = time net fully deployed,
C = time net retrieval started, and
D = time net fully retrieved.

Once deployed at a station, gill nets were fished 30 min before retrieval started.

Daily CPUE (CPUE_d) was calculated as:

$$\text{CPUE}_d = \sum_{s=1}^n \text{CPUE}_s$$

The following physical and chemical measurements were taken at the start of each set: air temperature, water temperature (at 1 m below the surface), wind velocity and direction, tide stage, water depth, and water clarity. Air and water temperatures were measured using a YSI salinity/temperature meter. Unfortunately, the salinity meter malfunctioned during the project. Wind speed was measured in knots and direction was recorded as 0 (no wind), 1 (north), 2 (northeast), 3 (east), 4 (southeast), 5 (south), 6 (southwest), 7 (west), or 8 (northwest). Tide stage was classed as flood, ebb or slack by observing the movement of the vessel while drifting with the gill net. Water depth was measured in fm using a Simrad echo sounder, and water clarity was measured in m using a 17.5 cm secchi disk.

Describing the Salmon Migration

Catchability, the fraction of the available population taken by a defined unit of fishing effort, was estimated as:

$$q_d = c_d / r_d,$$

where: q_d = estimated catchability on day d,
 r_d = adjusted cumulative total return on day d, and
 c_d = cumulative CPUE on day d.

Passage rate, the expansion factor used to convert CPUE into estimated numbers of salmon passing the test fishing transect, was calculated as:

$$PR = 1/q_a = \text{passage rate}$$

Since the test fishery did not encompass the entire sockeye salmon run, the total CPUE for the test fishery was estimated after the season using the following relationship:

$$CPUE_t = CPUE_f \times \frac{H_t}{H_{(f+2)}},$$

where: $CPUE_t$ = total estimated CPUE for the season,
 $CPUE_f$ = cumulative CPUE through final day, f, of test fishing,
 H_t = total commercial harvest for the season
 $H_{(f+2)}$ = total commercial catch through final day of test fishery (f+2), and
 2 = number of days it took salmon to travel from test fishery to commercial harvest areas.

Estimates of $CPUE_t$ and $CPUE_a$ values were used to estimate daily and cumulative proportions of $CPUE_t$, based on a non-linear model:

$$y_a = 1/(1 + e^{-(a+bd)})$$

where: y_a = cumulative proportion of CPUE or return on day d,
 a and b = coefficients of model,
 d = day of observation.

To calculate mean date of return, the following formula was used:

$$M = a/b$$

where: M = mean date of return,

RESULTS

A total of 2,401 sockeye salmon, 35 pink salmon, *O. gorbuscha*, 671 chum salmon, *O. keta*, 690 coho salmon, *O. kisutch*, and 2 chinook salmon, *O. tshawytscha*, were

captured during the 1991 test fishery (Table 1, Appendices A-D). Daily sockeye salmon catches ranged from 6 to 455 fish (Table 1).

Sockeye salmon daily CPUE values ranged from 5.0 on 24 July to 232.4 on 15 July. Cumulative total CPUE for the duration of the project was 1,574.1 (Table 1, Figure 2 and 3). Using post season commercial harvest figures, test fishing spanned approximately 89.5% of the total run. Therefore, total CPUE for the test fishery would have been 1,759, if test fishing had continued throughout the duration of the run.

Sockeye salmon catches along the transect were similar to the distribution of CPUE values. Approximately 86% of the total sockeye salmon catch and 84.1% of the total CPUE occurred at stations 5, 6, and 7 (Tables 2 and 3).

Examination of daily and cumulative proportions (estimated post season) of the sockeye salmon run to UCI suggested that only 1.4% of the run had passed the transect prior to the start of test fishing on 1 July and that the run was 91.6% completed at project termination (Appendix E; Figure 4). The mean date of the run was 17 July 1991 which was 3 d late relative to the historic average (Table 4).

The total sockeye salmon run to UCI in 1991 was estimated to be 3,600,000 fish of which 2,177,576 were harvested in the commercial fishery (Table 5). Estimated passage rate for the season was 2,047 sockeye salmon per CPUE index point.

Water temperatures measured along the transect generally increased during the season from a low of 8.0°C early in July to a high of 11.5°C in mid-July (Appendix F). Air temperatures fluctuated between 8°C and 15°C during the project (Appendix F). Wind velocities were generally moderate. However, winds of 20 knots or greater were recorded on 2 days (Appendix F). Wind direction was typically from the southeast or northeast.

During the commercial salmon fishing season five estimates of the sockeye salmon total run were made (Table 6). Past studies suggested that the initial best fit estimate was not accurate in predicting total run during the season and that the second or third best fit estimate was usually more useful. This pattern was again evident in 1991 as the initial best fit estimate (1990 run timing) on 11 July was 9,700,000 fish, while the third best fit (1983 run timing) was 4,200,000 fish. Although both estimators produced smaller run size predictions as the season progressed, 1990 run timing suggested the run was well above its actual size (3,600,000) until 30 July. Estimates based on 1983 run timing ranged from 3,400,000 to 4,200,000 fish. In contrast, estimates based on 1990 run timing ranged from 9,700,000 to 3,200,000 fish. During a critical management time period (16 - 18 July) the 1990 timing data suggested that the 1991 run could be 5,300,000 fish. The 1983 comparison bracketed the actual total return with a range of 3.4 to 4.1 million fish (Table 6 and 7). Consistent with previous investigations initial estimates of total CPUE were low (Table 7) and passage rate was estimated high (Table 8).

Addition of sampling effort at station 6a (Table 9) did not alter estimated mean timing of the sockeye salmon run. Visual comparison of run timing curves with and without station 6a indicated no major differences (Figure 4). Using only station 6a data to define run timing indicated that the run was 1 day earlier than was shown by combining data from all stations.

DISCUSSION

The 1991 season again demonstrated the continuing problem of the Upper Cook Inlet offshore test fish program. Initial estimates show a bias towards estimating timing to be later than the actual run. Therefore, estimates are generally greater than the actual return early in the season. In 1991, fishery managers in Upper Cook Inlet recognized this problem and chose to use the third best fit year as a more reasonable approximation of the run. While this proved successful for the 1991 season it was a subjective decision which may not be applicable all years. To improve the reliability of the offshore test fishing program, more effort and monies must be allocated to determine the cause of these problems. Increased sampling power using hydroacoustic techniques or more fishing vessels may be one solution.

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Table 1. Summary of fishing time, daily and cumulative sockeye salmon catch and CPUE, Upper Cook Inlet offshore test fishing project, 1991.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE		Mean Length (mm)
			Daily	Cum	Daily	Cum	
01 July	5	195.5	50	50	35.2	35.2	539
02 July	4	131.5	16	66	12.0	47.2	510
03 July	5	186.0	8	74	5.6	52.8	525
04 July	5	188.5	26	100	20.3	73.1	515
05 July	5	186.0	33	133	26.2	99.3	524
06 July	5	190.5	46	179	35.7	135.0	522
07 July	5	188.5	43	222	34.2	169.2	524
08 July	5	186.5	34	256	26.9	196.1	529
09 July	5	189.5	62	318	48.2	244.2	547
10 July	5	186.5	35	353	26.7	270.9	522
11 July	5	204.5	163	516	108.1	379.0	545
12 July	5	188.5	76	592	55.7	434.7	546
13 July	5	217.5	234	826	146.4	581.2	558
14 July	5	180.0	34	860	25.1	606.3	556
15 July	5	230.0	455	1315	232.4	838.7	564
16 July	5	195.0	97	1412	71.6	910.3	556
17 July	5	187.5	20	1432	15.7	926.0	557
18 July	5	196.0	136	1568	96.8	1022.8	562
19 July	5	192.5	50	1618	37.9	1060.8	551
20 July	5	180.0	117	1735	75.9	1136.7	550
21 July	5	200.0	50	1785	35.8	1172.5	564
22 July	5	200.0	125	1910	80.8	1253.3	573
23 July	5	194.5	61	1971	41.7	1295.0	548
24 July	5	178.0	6	1977	5.0	1300.1	555
25 July	5	191.5	52	2029	37.3	1337.4	586
26 July	5	192.5	37	2066	25.9	1363.3	
27 July	5	191.5	141	2207	84.4	1447.7	565
28 July	3	110.5	28	2235	21.1	1468.8	557
29 July	5	202.6	152	2387	93.5	1562.3	565
30 July	5	157.5	14	2401	11.8	1574.1	572

Table 2. Estimated sockeye salmon catch by date and station, Upper Cook Inlet offshore test fishing project, 1991.

Date	Station Number					Total
	4	5	6	7	8	
01 July	1	41	6	0	2	50
02 July	0	1	0	15		16
03 July	1	3	1	2	1	8
04 July	13	10	0	2	1	26
05 July	20	12	0	1	0	33
06 July	2	7	14	7	16	46
07 July	13	18	1	11	0	43
08 July	4	4	19	7	0	34
09 July	2	27	12	21	0	62
10 July	0	33	0	1	1	35
11 July	3	90	58	3	9	163
12 July	39	36	1	0	0	76
13 July	2	95	48	87	2	234
14 July	3	0	25	5	1	34
15 July	0	13	241	201	0	455
16 July	3	20	4	45	25	97
17 July	6	6	6	0	2	20
18 July	7	71	38	11	9	136
19 July	16	29	1	2	2	50
20 July	13	100	2	1	1	117
21 July	3	12	20	15	0	50
22 July	0	15	17	90	3	125
23 July	1	0	9	2	49	61
24 July	0	0	3	3	0	6
25 July	1	0	3	9	39	52
26 July	0	2	24	10	1	37
27 July	0	5	100	34	2	141
28 July			20	6	2	28
29 July	1	90	13	45	3	152
30 July	0	0	11	0	3	14
Total	154	740	697	636	174	2401
%	6.4	30.8	29.0	26.5	7.2	100.0

Table 3. Estimated sockeye salmon CPUE by date and station, Upper Cook Inlet offshore test fishing project, 1991.

Date	Station Number					Total
	4	5	6	7	8	
01 July	0.7	28.0	4.6	0.0	1.8	35.2
02 July	0.0	0.8	0.0	11.2		12.0
03 July	0.8	1.6	0.8	1.6	0.8	5.6
04 July	10.1	7.7	0.0	1.6	0.8	20.3
05 July	15.6	9.7	0.0	0.8	0.0	26.2
06 July	1.6	5.9	10.8	5.5	11.9	35.7
07 July	10.3	14.6	0.8	8.6	0.0	34.2
08 July	3.2	3.2	14.8	5.6	0.0	26.9
09 July	1.6	20.5	9.5	16.6	0.0	48.2
10 July	0.0	25.0	0.0	0.8	0.8	26.7
11 July	5.0	55.7	37.4	2.5	7.5	108.1
12 July	28.2	26.7	0.8	0.0	0.0	55.7
13 July	1.6	60.0	32.7	50.4	1.6	146.4
14 July	2.5	0.0	18.1	3.8	0.8	25.1
15 July	0.0	10.8	117.6	103.9	0.0	232.4
16 July	2.5	15.4	3.2	31.8	18.7	71.6
17 July	4.7	4.8	4.5	0.0	1.7	15.7
18 July	5.7	47.4	27.1	9.0	7.6	96.8
19 July	12.5	21.5	0.8	1.6	1.6	37.9
20 July	10.3	58.3	5.7	0.8	0.8	75.9
21 July	2.5	9.6	14.0	9.8	0.0	35.8
22 July	0.0	12.2	12.7	53.5	2.4	80.8
23 July	0.8	0.0	7.0	1.6	32.3	41.7
24 July	0.0	0.0	2.5	2.5	0.0	5.0
25 July	0.8	0.0	2.5	6.8	27.2	37.3
26 July	0.0	1.7	15.5	7.9	0.8	25.9
27 July	0.0	3.3	56.3	23.2	1.6	84.4
28 July			12.0	7.5	1.6	21.1
29 July	1.1	54.5	9.0	26.5	2.4	93.5
30 July	0.0	0.0	9.3	0.0	2.5	11.8
Total	122.1	499.0	430.0	395.51	27.5	1574.1
%	7.8	31.7	27.3	25.1	8.1	100.0

Table 4. Mean date of the sockeye salmon run across Anchor Point transect, Upper Cook Inlet offshore test fishing project, 1979-1991.

Year	Mean Date*	
	Coded	Calendar
1979	18.4	July 11
1980	22.7	July 15
1981	13.2	July 06
1982	24.2	July 17
1983	22.6	July 15
1984	18.4	July 11
1985	22.7	July 15
1986	23.0	July 16
1987	25.7	July 18
1988	20.6	July 13
1989	21.6	July 14
1990	25.6	July 18
1991	24.3	July 17
1979-1990	21.5	July 14

* Day (1) = June 24.

Table 5. The 1991 Upper Cook Inlet commercial salmon harvest.

Date	Number of Deliveries	Chinook		Sockeye		Coho		Pink		Chum		Total	
		Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
5-27 Mon	8	66	66	91	91							157	157
5-31 Fri	14	71	137	551	642							622	779
6-03 Mon	120	3,047	3,184	1,854	2,496							4,901	5,680
6-07 Fri	23	239	3,423	3,243	5,739							3,482	9,162
6-10 Mon	137	1,929	5,352	4,224	9,963							6,153	15,315
6-14 Fri	14	26	5,378	2,124	12,087							2,150	17,465
6-17 Mon	140	1,610	6,988	4,303	16,390							5,913	23,378
6-21 Fri	30	57	7,045	959	17,349							1,016	24,394
6-24 Mon	93	386	7,431	1,477	18,826	3	3	1	1	1	1	1,868	26,262
6-28 Fri	110	343	7,774	6,476	25,302	4	7	5	6	40	41	6,868	33,130
7-01 Mon	283	455	8,229	37,360	62,662	69	76	43	49	284	325	38,211	71,341
7-05 Fri	308	500	8,729	41,257	103,919	404	480	148	197	312	637	42,621	113,962
7-06 Sat	166	240	8,969	15,178	119,097	21	501	110	307	10	647	15,559	129,521
7-08 Mon	912	649	9,618	198,501	317,598	5,196	5,697	400	707	6,838	7,485	211,584	341,105
7-12 Fri	588	661	10,279	40,701	358,299	1,113	6,810	626	1,333	141	7,626	43,242	384,347
7-15 Mon	1107	840	11,119	556,641	914,940	47,510	54,320	3,172	4,505	26,925	34,551	635,088	1,019,435
7-18 Thu	159	139	11,258	118,691	1,033,631	118	54,438	65	4,570	6	34,557	119,019	1,138,454
7-19 Fri	1329	632	11,890	590,619	1,624,250	52,810	107,248	3,975	8,545	39,153	73,710	687,189	1,825,643
7-20 Sat	204	263	12,153	50,383	1,674,633	184	107,432	352	8,897	9	73,719	51,191	1,876,834
7-21 Sun	31		12,153	5,319	1,679,952	943	108,375	11	8,908	427	74,146	6,700	1,883,534
7-22 Mon	196	21	12,174	27,529	1,707,481	18,002	126,377	2,000	10,908	2,782	76,928	50,334	1,933,868
7-23 Tue	22		12,174	5,140	1,712,621	687	127,064	10	10,918	534	77,462	6,371	1,940,239
7-26 Fri	2		12,174	78	1,712,699	64	127,128	22	10,940	373	77,835	537	1,940,776
7-29 Mon	954	347	12,521	142,753	1,855,452	22,998	150,126	981	11,921	31,769	109,604	198,848	2,139,624
7-31 Wed	366	129	12,650	27,994	1,883,446	5,712	155,838	119	12,040	1,647	111,251	35,601	2,175,225
8-01 Thu	569	163	12,813	65,478	1,948,924	9,198	165,036	263	12,303	5,397	116,648	80,499	2,255,724
8-02 Fri	954	194	13,007	95,132	2,044,056	58,335	223,371	1,043	13,346	43,230	159,878	197,934	2,453,658
8-03 Sat	452	133	13,140	20,405	2,064,461	4,669	228,040	132	13,478	392	160,270	25,731	2,479,389
8-04 Sun	327	120	13,260	17,310	2,081,771	6,382	234,422	61	13,539	398	160,668	24,271	2,503,660
8-05 Mon	862	149	13,409	47,914	2,129,685	46,113	280,535	576	14,115	52,358	213,026	147,110	2,650,770

- Continued -

Table 5. (p. 2 of 2)

Date	Number of Deliveries	Chinook		Sockeye		Coho		Pink		Chum		Total	
		Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
8-09 Fri	571	61	13,470	19,511	2,149,196	35,036	315,571	178	14,293	27,100	240,126	81,886	2,732,656
8-12 Mon	416	49	13,519	15,399	2,164,595	30,758	346,329	205	14,498	19,428	259,554	65,839	2,798,495
8-16 Fri	191	3	13,522	3,195	2,167,790	16,430	362,759	59	14,557	8,772	268,326	28,459	2,826,954
8-19 Mon	134	4	13,526	2,433	2,170,223	12,511	375,270	48	14,605	4,695	273,021	19,691	2,846,645
8-21 Wed	103	2	13,528	2,218	2,172,441	12,567	387,837	32	14,637	2,728	275,749	17,547	2,864,192
8-23 Fri	130	2	13,530	2,184	2,174,625	11,276	399,113	19	14,656	2,402	278,151	15,883	2,880,075
8-26 Mon	74		13,530	1,131	2,175,756	7,233	406,346	2	14,658	1,473	279,624	9,839	2,889,914
8-28 Wed	47	3	13,533	1,077	2,176,833	4,333	410,679	5	14,663	188	279,812	5,606	2,895,520
8-30 Fri	40	1	13,534	264	2,177,097	3,971	414,650		14,663	294	280,106	4,530	2,900,050
9-02 Mon	44		13,534	258	2,177,355	3,356	418,006		14,663	21	280,127	3,635	2,903,685
9-04 Wed	29		13,534	57	2,177,412	2,772	420,778		14,663	22	280,149	2,851	2,906,536
9-06 Fri	28		13,534	124	2,177,536	2,622	423,400		14,663	17	280,166	2,763	2,909,299
9-09 Mon	15		13,534	5	2,177,541	690	424,090		14,663	8	280,174	703	2,910,002
9-11 Wed	15	1	13,535	13	2,177,554	740	424,830		14,663	38	280,212	792	2,910,794
9-13 Fri	12		13,535	17	2,177,571	526	425,356		14,663	9	280,221	552	2,911,346
9-16 Mon	4		13,535		2,177,571	224	425,580		14,663	2	280,223	226	2,911,572
9-18 Wed	4		13,535	4	2,177,575	119	425,699		14,663		280,223	123	2,911,695
9-23 Mon	1		13,535	1	2,177,576	25	425,724		14,663		280,223	26	2,911,721

Table 6. Total offshore test fishing CPUE and total sockeye salmon run estimates, Upper Cook Inlet, 1991.

Date	Cum CPUE ^a	Best Fit Year	MSSDEV ^b	Passage Rate	Total CPUE	Total Run Estimate (X 10 ⁶)	Percent Error ^c
11 July	379.0	1990	.000018	4,212	2,311	9.7	169.4
		1983	.000395	4,212	1,017	4.2	16.7
16 July	910.3	1990	.000122	2,834	2,536	7.1	97.2
		1983	.002632	2,834	1,459	4.1	16.7
18 July	1022.8	1990	.000198	2,160	2,473	5.3	47.2
		1983	.002889	2,160	1,563	3.4	-5.6
20 July	1136.7	1990	.000553	2,454	2,326	5.7	58.3
		1983	.002688	2,454	1,596	3.9	8.3
30 July	1574.1	1990	.000769	1,997	1,600	3.2	-11.1
		1983	.001892	1,997	1,856	3.7	2.8

^a Cumulative CPUE from start of test fishing to estimated end of total run.

^b Mean sum of squared deviation.

^c Percent error = $\frac{\text{predicted}-\text{actual}}{\text{actual}}$

Table 7. Performance of 1983 run timing model as a predictor of total sockeye salmon run size in 1991, Upper Cook Inlet, offshore test fishing project.

Date	CPUE ^a			Total Return ^b	
	Percent of Total Run	Estimate of Total	Percent Error ^c (%)	Estimate (millions)	Percent Error ^d (%)
11 July	23.3	1,017	-42.2	4.2	16.7
16 July	43.9	1,459	-17.1	4.1	13.9
18 July	53.3	1,563	-11.1	3.4	-5.6
20 July	62.4	1,596	- 9.3	3.9	8.3
30 July	91.6	1,856	5.5	3.7	2.8

^a Total CPUE for season was 1,759. Percent migration based on curve fit of daily index points.

^b Total sockeye salmon return was 3.6 million fish.

^c Mean percent error (MPE) = -14.8

Absolute MPE (AMPE) = 17.0

^d MPE = 7.2

AMPE = 9.5

Table 8. Estimates of sockeye salmon catchability, passage rate, and relative error of estimates, Upper Cook Inlet, Alaska offshore test fishing project, 1991.

Date	Catchability ^a		Passage Rate ^b	
	q	Percent Error (%)	$\frac{1}{q}$	Percent Error (%)
11 July	0.000237	-51.5	4,212	105.8
16 July	0.000353	-27.8	2,834	38.4
18 July	0.000463	- 5.3	2,160	5.5
20 July	0.000407	-16.8	2,454	19.9
30 July	0.000500	2.2	1,997	-2.4

^a Catchability (q) for 1991 was 0.000489.

^b Passage rate for 1991 was 2,047 fish per unit of effort?

^c MPE = 19.8

AMPE = 20.7

^d MPE = 33.4

AMPE = 34.4

Table 9. Summary of sockeye salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE at Station 6a, Upper Cook Inlet offshore test fishing project, 1991.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE	
			Daily	Cum	Daily	Cum
02 July	1	40.5	20	20	14.8	14.8
03 July	1	36.5	0	20	0.0	14.8
04 July	0	.0	0	20	0.0	14.8
05 July	1	37.5	3	23	2.4	17.2
06 July	0	.0	0	23	0.0	17.2
07 July	1	38.5	5	28	3.9	21.1
08 July	0	.0	0	28	0.0	21.1
09 July	1	32.5	31	59	28.6	49.7
10 July	0	.0	0	59	0.0	49.7
11 July	1	52.0	131	190	75.6	125.3
12 July	0	.0	0	190	0.0	125.3
13 July	1	41.5	36	226	26.0	151.4
14 July	0	.0	0	226	0.0	151.4
15 July	1	12.0	17	243	87.0	238.4
16 July	0	.0	0	243	0.0	238.4
17 July	1	37.5	2	245	1.6	240.0
18 July	0	.0	0	245	0.0	240.0
19 July	1	38.0	1	246	0.8	240.7
20 July	0	.0	0	246	0.0	240.7
21 July	1	48.0	32	278	20.0	260.7
22 July	0	.0	0	278	0.0	260.7
23 July	1	37.0	2	280	1.6	262.4
24 July	0	.0	0	280	0.0	262.4
25 July	1	45.5	69	349	45.5	307.8
26 July	0	.0	0	349	0.0	307.8
27 July	1	41.5	14	363	13.3	321.2
28 July	0	.0	0	363	0.0	321.2
29 July	1	46.5	54	417	34.8	356.0

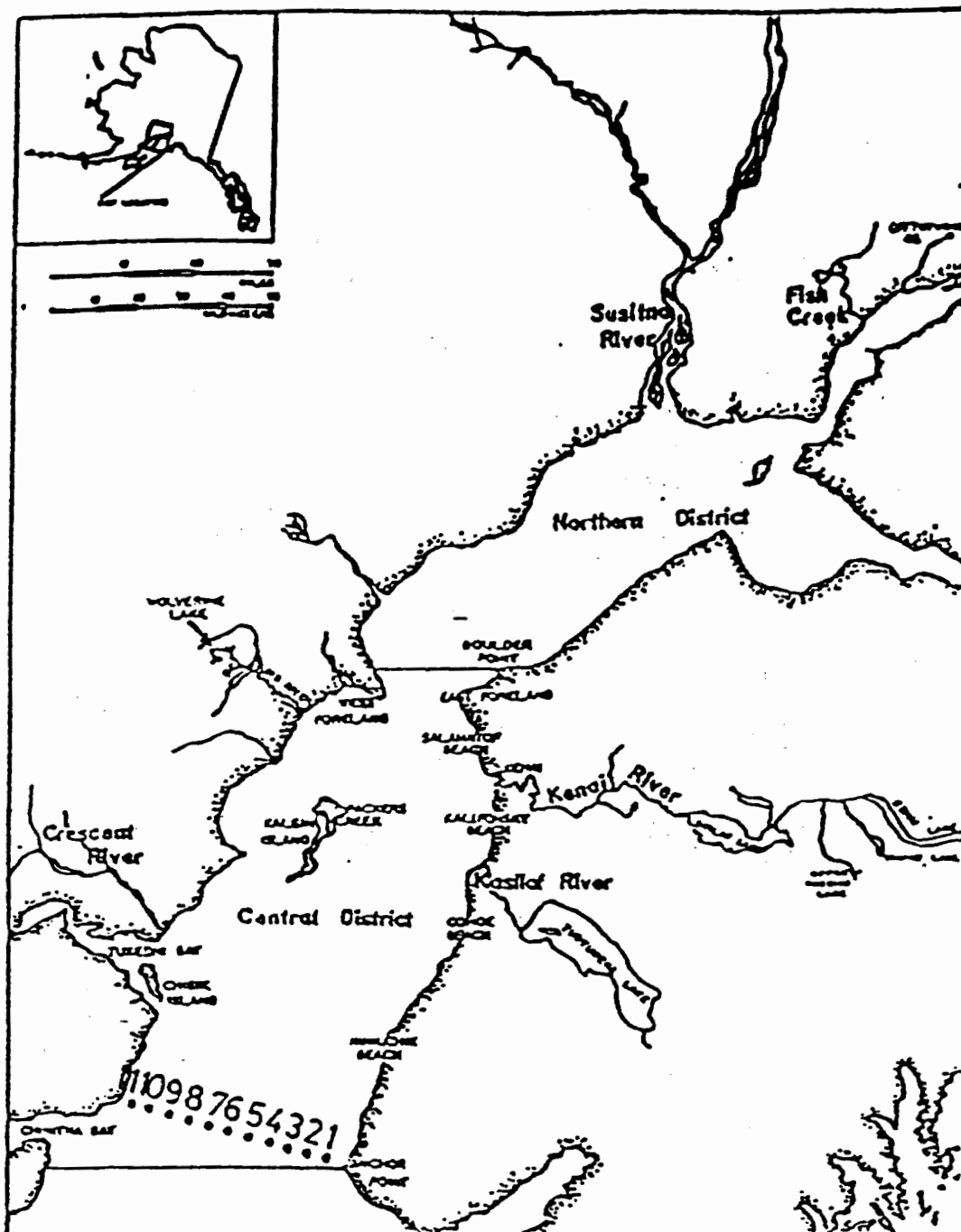


Figure 1. Map of Upper Cook Inlet, Alaska, showing location of Offshore Test Fish transect.

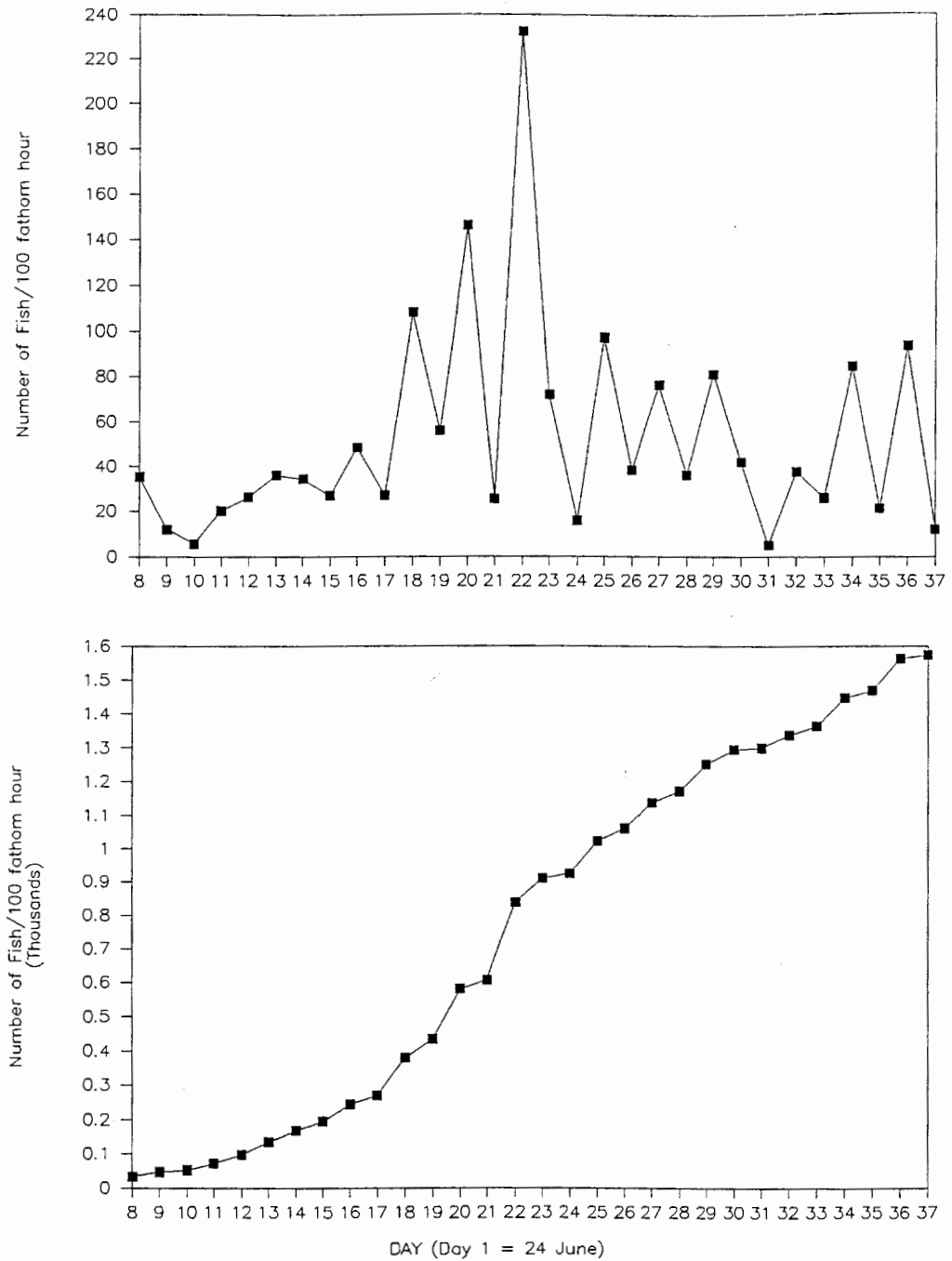


Figure 2. Daily (upper) and cumulative (lower) CPUE for sockeye salmon recorded during the 1991 offshore test fish project, Upper Cook Inlet, Alaska.

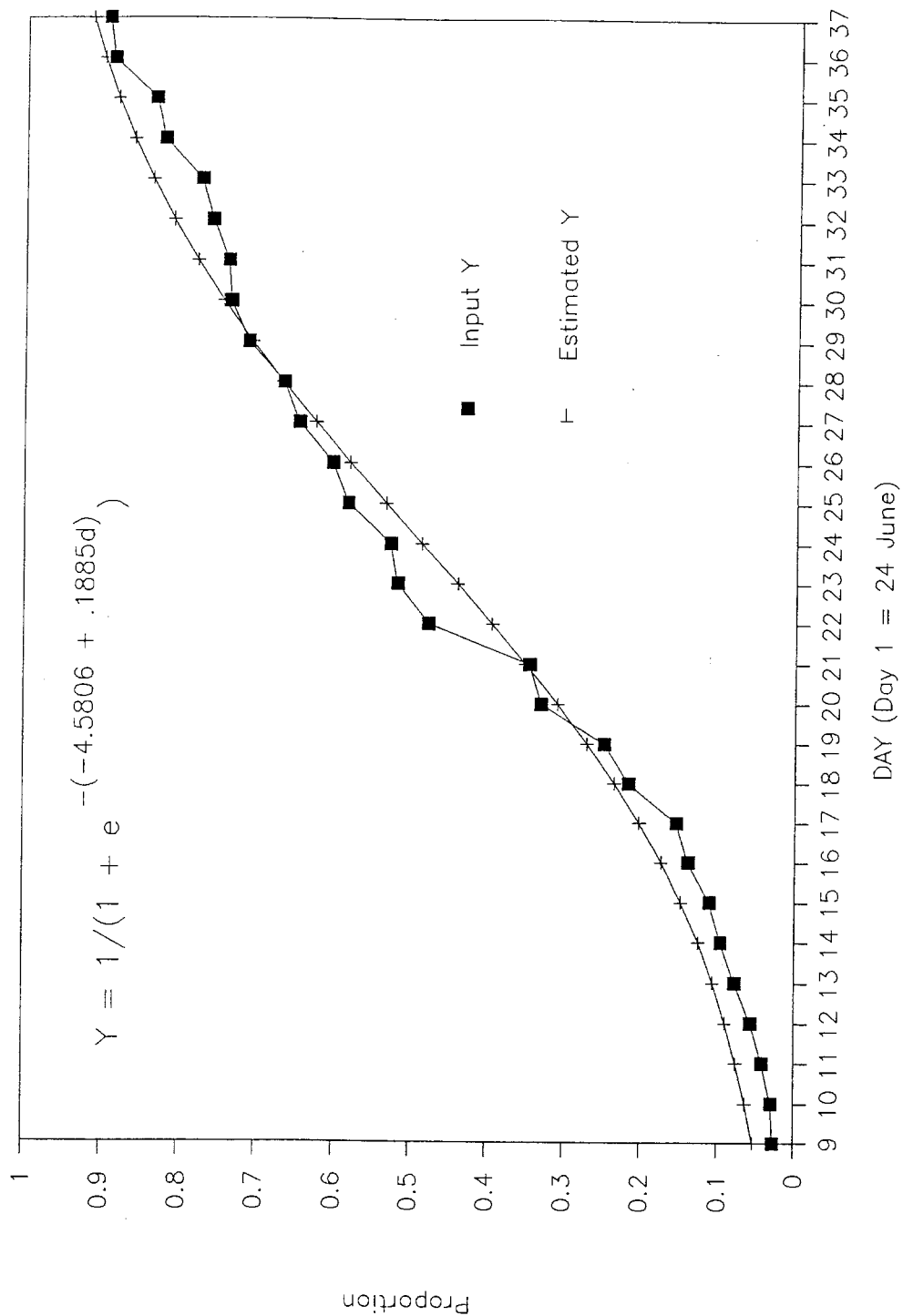


Figure 3. Cumulative proportions estimated for the sockeye salmon return to Upper Cook Inlet, Alaska, in 1991.

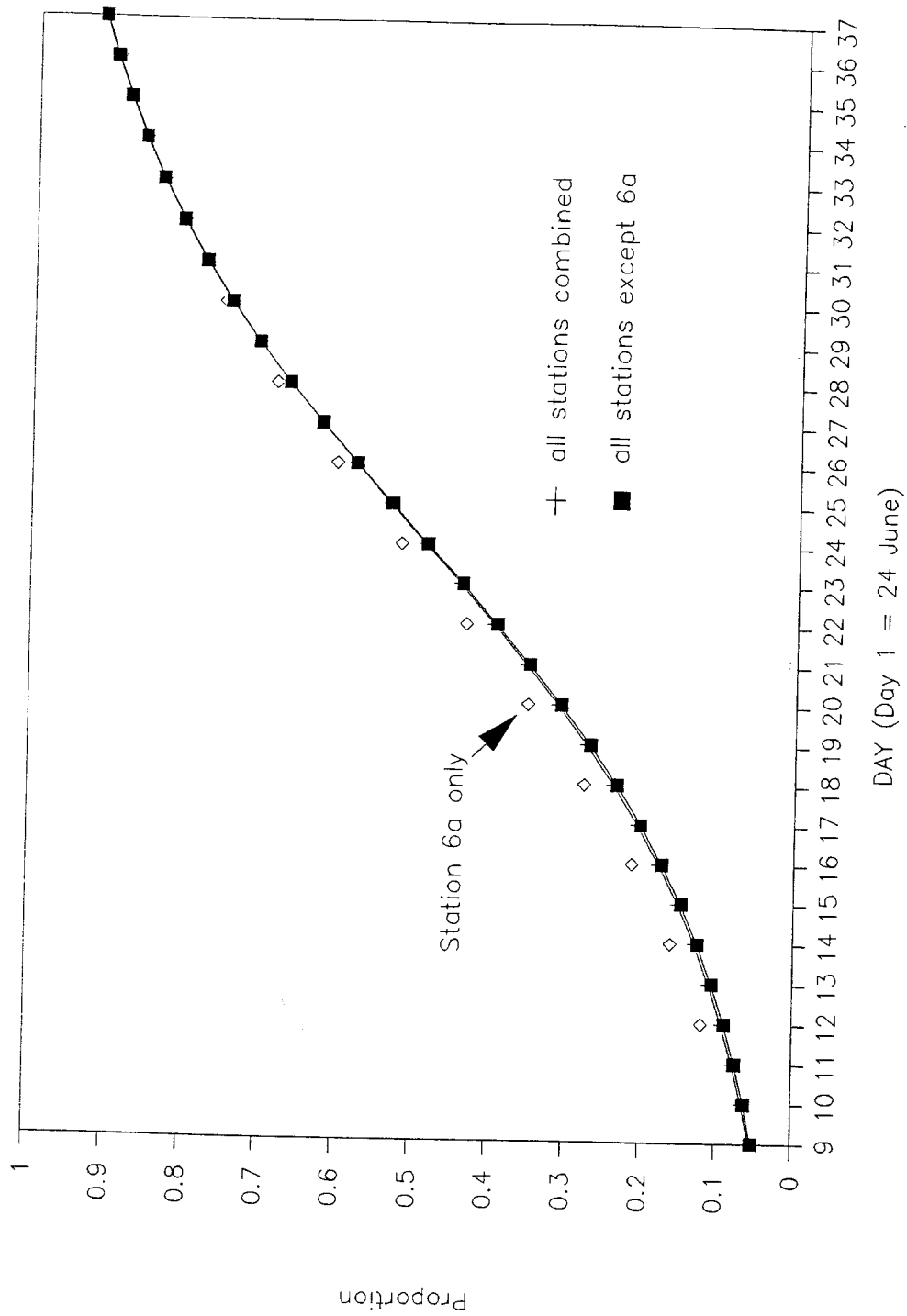


Figure 4. Cumulative proportions for all stations combined, station 6a only, and all stations except 6a for the sockeye salmon return to Upper Cook Inlet, Alaska, in 1991.

Appendix A.1. Summary of pink salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fishing project, 1991.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE	
			Daily	Cum	Daily	Cum
01 July	5	195.5	0	0	0.0	0.0
02 July	4	131.5	0	0	0.0	0.0
03 July	5	186.0	0	0	0.0	0.0
04 July	5	188.5	0	0	0.0	0.0
05 July	5	186.0	0	0	0.0	0.0
06 July	5	190.5	0	0	0.0	0.0
07 July	5	188.5	0	0	0.0	0.0
08 July	5	186.5	0	0	0.0	0.0
09 July	5	189.5	0	0	0.0	0.0
10 July	5	186.5	1	1	0.8	0.8
11 July	5	204.5	1	2	0.6	1.4
12 July	5	188.5	0	2	0.0	1.4
13 July	5	217.5	3	5	2.1	3.6
14 July	5	180.0	1	6	1.6	5.2
15 July	5	230.0	3	9	1.5	6.6
16 July	5	195.0	1	10	0.7	7.4
17 July	5	187.5	0	10	0.0	7.4
18 July	5	196.0	6	16	4.5	11.8
19 July	5	192.5	1	17	0.8	12.6
20 July	5	180.0	4	21	2.8	15.4
21 July	5	200.0	2	23	1.3	16.8
22 July	5	200.0	2	25	1.6	18.4
23 July	5	194.5	4	29	2.8	21.1
24 July	5	178.0	1	30	0.8	22.0
25 July	5	191.5	1	31	0.7	22.7
26 July	5	192.5	1	32	0.6	23.3
27 July	5	191.5	0	32	0.0	23.3
28 July	3	110.5	0	32	0.0	23.3
29 July	5	202.6	2	34	1.3	24.6
30 July	5	157.5	1	35	0.8	25.5

Appendix A.2. Estimated pink salmon catch by date and station, Upper Cook Inlet offshore test fishing project, 1991.

Date	Station Number					Total
	4	5	6	7	8	
01 July	0	0	0	0	0	0
02 July	0	0	0	0		0
03 July	0	0	0	0	0	0
04 July	0	0	0	0	0	0
05 July	0	0	0	0	0	0
06 July	0	0	0	0	0	0
07 July	0	0	0	0	0	0
08 July	0	0	0	0	0	0
09 July	0	0	0	0	0	0
10 July	0	1	0	0	0	1
11 July	0	0	1	0	0	1
12 July	0	0	0	0	0	0
13 July	1	0	2	0	0	3
14 July	0	1	0	0	0	1
15 July	0	0	3	0	0	3
16 July	0	0	0	0	1	1
17 July	0	0	0	0	0	0
18 July	1	3	0	1	1	6
19 July	1	0	0	0	0	1
20 July	1	2	0	1	0	4
21 July	0	0	1	1	0	2
22 July	0	1	0	0	1	2
23 July	0	0	1	0	3	4
24 July	0	0	1	0	0	1
25 July	0	0	0	0	1	1
26 July	0	0	1	0	0	1
27 July	0	0	0	0	0	0
28 July			0	0	0	0
29 July	0	1	1	0	0	2
30 July	0	0	0	0	1	1
Total	4	9	11	3	8	35
%	11.4	25.7	31.4	8.6	22.9	100.0

Appendix A.3. Estimated pink salmon CPUE by date and station, Upper Cook Inlet offshore test fishing project, 1991.

Date	Station Number					Total
	4	5	6	7	8	
01 July	0.0	0.0	0.0	0.0	0.0	0.0
02 July	0.0	0.0	0.0	0.0		0.0
03 July	0.0	0.0	0.0	0.0	0.0	0.0
04 July	0.0	0.0	0.0	0.0	0.0	0.0
05 July	0.0	0.0	0.0	0.0	0.0	0.0
06 July	0.0	0.0	0.0	0.0	0.0	0.0
07 July	0.0	0.0	0.0	0.0	0.0	0.0
08 July	0.0	0.0	0.0	0.0	0.0	0.0
09 July	0.0	0.0	0.0	0.0	0.0	0.0
10 July	0.0	0.8	0.0	0.0	0.0	0.8
11 July	0.0	0.0	0.6	0.0	0.0	0.6
12 July	0.0	0.0	0.0	0.0	0.0	0.0
13 July	0.8	0.0	1.4	0.0	0.0	2.1
14 July	0.0	1.6	0.0	0.0	0.0	1.6
15 July	0.0	0.0	1.5	0.0	0.0	1.5
16 July	0.0	0.0	0.0	0.0	0.7	0.7
17 July	0.0	0.0	0.0	0.0	0.0	0.0
18 July	0.8	2.0	0.0	0.8	0.8	4.5
19 July	0.8	0.0	0.0	0.0	0.0	0.8
20 July	0.8	1.2	0.0	0.8	0.0	2.8
21 July	0.0	0.0	0.7	0.7	0.0	1.3
22 July	0.0	0.8	0.0	0.0	0.8	1.6
23 July	0.0	0.0	0.8	0.0	2.0	2.8
24 July	0.0	0.0	0.8	0.0	0.0	0.8
25 July	0.0	0.0	0.0	0.0	0.7	0.7
26 July	0.0	0.0	0.6	0.0	0.0	0.6
27 July	0.0	0.0	0.0	0.0	0.0	0.0
28 July			0.0	0.0	0.0	0.0
29 July	0.0	0.6	0.7	0.0	0.0	1.3
30 July	0.0	0.0	0.0	0.0	0.8	0.8
Total	4	9	11	3	8	35
%	12.4	27.3	28.0	9.1	23.2	100.0

Appendix B.1. Summary of chum salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fishing project, 1991.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE	
			Daily	Cum	Daily	Cum
01 July	5	195.5	2	2	1.5	1.5
02 July	4	131.5	1	3	0.8	2.3
03 July	5	186.0	0	3	0.0	2.3
04 July	5	188.5	3	6	2.4	4.7
05 July	5	186.0	2	8	1.6	6.3
06 July	5	190.5	1	9	0.8	7.1
07 July	5	188.5	8	17	6.2	13.3
08 July	5	186.5	8	25	6.3	19.6
09 July	5	189.5	5	30	3.9	23.6
10 July	5	186.5	9	39	6.9	30.5
11 July	5	204.5	15	54	9.5	39.9
12 July	5	188.5	1	55	0.7	40.7
13 July	5	217.5	32	87	19.9	60.6
14 July	5	180.0	7	94	5.3	65.8
15 July	5	230.0	44	138	21.9	87.7
16 July	5	195.0	11	149	8.2	95.9
17 July	5	187.5	3	152	2.3	98.2
18 July	5	196.0	14	166	10.1	108.3
19 July	5	192.5	9	175	6.8	115.1
20 July	5	180.0	12	187	12.4	127.5
21 July	5	200.0	24	211	15.5	143.0
22 July	5	200.0	46	257	29.1	172.2
23 July	5	194.5	24	281	17.3	189.5
24 July	5	178.0	3	284	2.5	192.0
25 July	5	191.5	19	303	13.9	205.9
26 July	5	192.5	64	367	41.6	247.5
27 July	5	191.5	77	444	44.0	291.5
28 July	3	110.5	64	508	38.4	329.9
29 July	5	202.6	161	669	101.1	431.1
30 July	5	157.5	2	671	1.7	432.7

Appendix B.2. Estimated chum salmon catch by date and station,
Upper Cook Inlet offshore test fishing project, 1991.

Date	Station Number					Total
	4	5	6	7	8	
01 July	1	0	1	0	0	2
02 July	0	0	1	0		1
03 July	0	0	0	0	0	0
04 July	0	2	0	1	0	3
05 July	0	2	0	0	0	2
06 July	0	0	1	0	0	1
07 July	0	0	8	0	0	8
08 July	0	0	3	5	0	8
09 July	2	2	1	0	0	5
10 July	0	8	0	0	1	9
11 July	0	9	6	0	0	15
12 July	0	1	0	0	0	1
13 July	0	17	4	11	0	32
14 July	0	0	2	4	1	7
15 July	0	1	41	2	0	44
16 July	0	0	4	6	1	11
17 July	1	0	2	0	0	3
18 July	2	5	6	1	0	14
19 July	1	3	5	0	0	9
20 July	3	6	2	0	1	12
21 July	0	3	8	12	1	24
22 July	0	0	8	35	3	46
23 July	1	0	6	5	12	24
24 July	2	0	0	1	0	3
25 July	0	0	0	10	9	19
26 July	0	1	62	1	0	64
27 July	0	0	60	15	2	77
28 July			64	0	0	64
29 July	1	63	35	56	6	161
30 July	0	0	2	0	0	2
Total	14	123	332	165	37	671
%	2.1	18.3	49.5	24.6	5.5	100.0

Appendix B.3. Estimated chum salmon CPUE by date and station,
Upper Cook Inlet offshore test fishing project, 1991.

Date	Station Number					Total
	4	5	6	7	8	
01 July	0.7	0.0	0.8	0.0	0.0	1.5
02 July	0.0	0.0	0.8	0.0		0.8
03 July	0.0	0.0	0.0	0.0	0.0	0.0
04 July	0.0	1.5	0.0	0.8	0.0	2.4
05 July	0.0	1.6	0.0	0.0	0.0	1.6
06 July	0.0	0.0	0.8	0.0	0.0	0.8
07 July	0.0	0.0	6.2	0.0	0.0	6.2
08 July	0.0	0.0	2.3	4.0	0.0	6.3
09 July	1.6	1.5	0.8	0.0	0.0	3.9
10 July	0.0	6.1	0.0	0.0	0.8	6.9
11 July	0.0	5.6	3.9	0.0	0.0	9.5
12 July	0.0	0.7	0.0	0.0	0.0	0.7
13 July	0.0	10.7	2.7	6.4	0.0	19.9
14 July	0.0	0.0	1.4	3.0	0.8	5.3
15 July	0.0	0.8	20.0	1.0	0.0	21.9
16 July	0.0	0.0	3.2	4.2	0.7	8.2
17 July	0.8	0.0	1.5	0.0	0.0	2.3
18 July	1.6	3.3	4.3	0.8	0.0	10.1
19 July	0.8	2.2	3.8	0.0	0.0	6.8
20 July	2.4	3.5	5.7	0.0	0.8	12.4
21 July	0.0	2.4	4.5	7.8	0.8	15.5
22 July	0.0	0.0	6.0	20.7	2.4	29.1
23 July	0.8	0.0	4.7	3.9	7.9	17.3
24 July	1.7	0.0	0.0	0.8	0.0	2.5
25 July	0.0	0.0	0.0	7.6	6.3	13.9
26 July	0.0	0.8	40.0	0.8	0.0	41.6
27 July	0.0	0.0	32.2	10.2	1.6	44.0
28 July			38.4	0.0	0.0	38.4
29 July	1.1	38.2	24.1	32.9	4.7	101.1
30 July	0.0	0.0	1.7	0.0	0.0	1.7
Total	11.6	79.1	209.9	105.2	26.9	432.7
%	2.7	18.3	48.5	24.3	6.2	100.0

Appendix C.1. Summary of coho salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fishing project, 1991.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE	
			Daily	Cum	Daily	Cum
01 July	5	195.5	0	0	0.0	0.0
02 July	4	131.5	0	0	0.0	0.0
03 July	5	186.0	2	2	1.6	1.6
04 July	5	188.5	2	4	1.6	3.2
05 July	5	186.0	0	4	0.0	3.2
06 July	5	190.5	2	6	1.5	4.7
07 July	5	188.5	1	7	0.8	5.5
08 July	5	186.5	0	7	0.0	5.5
09 July	5	189.5	6	13	4.7	10.2
10 July	5	186.5	7	20	5.5	15.7
11 July	5	204.5	28	48	18.3	34.0
12 July	5	188.5	5	53	3.8	37.8
13 July	5	217.5	42	95	26.3	64.1
14 July	5	180.0	44	139	33.0	97.1
15 July	5	230.0	11	150	5.8	102.9
16 July	5	195.0	24	174	17.9	120.8
17 July	5	187.5	15	189	11.2	132.0
18 July	5	196.0	10	199	7.8	139.8
19 July	5	192.5	20	219	15.2	155.0
20 July	5	180.0	41	260	37.6	192.6
21 July	5	200.0	89	349	59.9	252.5
22 July	5	200.0	42	391	28.5	281.0
23 July	5	194.5	30	421	21.7	302.7
24 July	5	178.0	4	425	3.4	306.1
25 July	5	191.5	19	444	14.2	320.3
26 July	5	192.5	34	478	23.1	343.4
27 July	5	191.5	71	549	45.4	388.8
28 July	3	110.5	53	602	35.5	424.3
29 July	5	202.6	87	689	56.8	481.1
30 July	5	157.5	1	690	0.8	481.9

Appendix C.3. Estimated coho salmon CPUE by date and station,
Upper Cook Inlet offshore test fishing project, 1991.

Date	Station Number					Total
	4	5	6	7	8	
01 July	0.0	0.0	0.0	0.0	0.0	0.0
02 July	0.0	0.0	0.0	0.0		0.0
03 July	0.0	0.8	0.0	0.0	0.8	1.6
04 July	0.0	0.0	1.6	0.0	0.0	1.6
05 July	0.0	0.0	0.0	0.0	0.0	0.0
06 July	0.0	0.0	1.5	0.0	0.0	1.5
07 July	0.0	0.0	0.0	0.8	0.0	0.8
08 July	0.0	0.0	0.0	0.0	0.0	0.0
09 July	1.6	1.5	0.0	1.6	0.0	4.7
10 July	0.8	2.3	2.4	0.0	0.0	5.5
11 July	0.0	3.7	12.9	0.0	1.7	18.3
12 July	1.4	1.5	0.8	0.0	0.0	3.8
13 July	0.0	3.2	8.9	13.4	0.8	26.3
14 July	0.0	0.0	11.6	18.2	3.2	33.0
15 July	0.0	0.0	2.9	2.1	0.8	5.8
16 July	0.8	3.1	2.4	7.1	4.5	17.9
17 July	0.0	0.0	11.2	0.0	0.0	11.2
18 July	0.0	0.0	2.9	4.1	0.8	7.8
19 July	2.3	1.5	11.4	0.0	0.0	15.2
20 July	4.7	18.1	11.4	1.7	1.6	37.6
21 July	0.8	2.4	16.0	39.8	0.8	59.9
22 July	0.0	0.8	5.2	13.7	8.8	28.5
23 July	2.5	0.0	2.3	7.0	9.9	21.7
24 July	0.8	1.7	0.8	0.0	0.0	3.4
25 July	0.8	0.0	3.3	3.0	7.0	14.2
26 July	0.0	3.3	17.4	2.4	0.0	23.1
27 July	0.0	0.8	13.9	26.6	4.1	45.4
28 July			25.2	3.7	6.6	35.5
29 July	1.1	13.3	11.0	19.4	11.8	56.8
30 July	0.0	0.0	0.0	0.0	0.8	0.8
Total	17.9	58.0	177.4	164.5	64.1	481.9
%	3.7	12.0	36.8	34.1	13.3	100.0

Appendix D.2. Estimated chinook salmon catch by date and station,
Upper Cook Inlet offshore test fishing project, 1991.

Date	Station Number					Total
	4	5	6	7	8	
01 July	0	0	0	0	0	0
02 July	0	0	0	0	0	0
03 July	0	0	0	0	0	0
04 July	0	0	0	0	0	0
05 July	0	0	0	0	0	0
06 July	0	0	0	0	0	0
07 July	0	0	1	1	0	2
08 July	0	0	0	0	0	0
09 July	0	0	0	0	0	0
10 July	0	0	0	0	0	0
11 July	0	0	0	0	0	0
12 July	0	0	0	0	0	0
13 July	0	0	0	0	0	0
14 July	0	0	0	0	0	0
15 July	0	0	0	0	0	0
16 July	0	0	0	0	0	0
17 July	0	0	0	0	0	0
18 July	0	0	0	0	0	0
19 July	0	0	0	0	0	0
20 July	0	0	0	0	0	0
21 July	0	0	0	0	0	0
22 July	0	0	0	0	0	0
23 July	0	0	0	0	0	0
24 July	0	0	0	0	0	0
25 July	0	0	0	0	0	0
26 July	0	0	0	0	0	0
27 July	0	0	0	0	0	0
28 July	0	0	0	0	0	0
29 July	0	0	0	0	0	0
30 July	0	0	0	0	0	0
Total	0	0	1	1	0	2
%	0.0	0.0	50.0	50.0	0.0	100.0

Appendix D.3. Estimated chinook salmon CPUE by date and station,
Upper Cook Inlet offshore test fishing project, 1991.

Date	Station Number					Total
	4	5	6	7	8	
01 July	0.0	0.0	0.0	0.0	0.0	0.0
02 July	0.0	0.0	0.0	0.0		0.0
03 July	0.0	0.0	0.0	0.0	0.0	0.0
04 July	0.0	0.0	0.0	0.0	0.0	0.0
05 July	0.0	0.0	0.0	0.0	0.0	0.0
06 July	0.0	0.0	0.0	0.0	0.0	0.0
07 July	0.0	0.0	0.8	0.8	0.0	1.6
08 July	0.0	0.0	0.0	0.0	0.0	0.0
09 July	0.0	0.0	0.0	0.0	0.0	0.0
10 July	0.0	0.0	0.0	0.0	0.0	0.0
11 July	0.0	0.0	0.0	0.0	0.0	0.0
12 July	0.0	0.0	0.0	0.0	0.0	0.0
13 July	0.0	0.0	0.0	0.0	0.0	0.0
14 July	0.0	0.0	0.0	0.0	0.0	0.0
15 July	0.0	0.0	0.0	0.0	0.0	0.0
16 July	0.0	0.0	0.0	0.0	0.0	0.0
17 July	0.0	0.0	0.0	0.0	0.0	0.0
18 July	0.0	0.0	0.0	0.0	0.0	0.0
19 July	0.0	0.0	0.0	0.0	0.0	0.0
20 July	0.0	0.0	0.0	0.0	0.0	0.0
21 July	0.0	0.0	0.0	0.0	0.0	0.0
22 July	0.0	0.0	0.0	0.0	0.0	0.0
23 July	0.0	0.0	0.0	0.0	0.0	0.0
24 July	0.0	0.0	0.0	0.0	0.0	0.0
25 July	0.0	0.0	0.0	0.0	0.0	0.0
26 July	0.0	0.0	0.0	0.0	0.0	0.0
27 July	0.0	0.0	0.0	0.0	0.0	0.0
28 July			0.0	0.0	0.0	0.0
29 July	0.0	0.0	0.0	0.0	0.0	0.0
30 July	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.8	0.8	0.0	1.6
%	0.0	0.0	50.0	50.0	0.0	100.0

Appendix E.1. Entry pattern of sockeye salmon into Upper Cook Inlet, Alaska, 1991, estimated from daily CPUE measured at the latitude of Anchor Point.

Day	Date	Input Y	Estimated Y
9	702	.0268	.0529
10	703	.0300	.0632
11	704	.0416	.0753
12	705	.0564	.0896
13	706	.0767	.1062
14	707	.0962	.1254
15	708	.1115	.1476
16	709	.1388	.1729
17	710	.1540	.2016
18	711	.2155	.2336
19	712	.2472	.2690
20	713	.3304	.3077
21	714	.3447	.3492
22	715	.4768	.3932
23	716	.5175	.4389
24	717	.5264	.4857
25	718	.5815	.5328
26	719	.6030	.5793
27	720	.6462	.6244
28	721	.6666	.6675
29	722	.7125	.7079
30	723	.7362	.7453
31	724	.7391	.7794
32	725	.7603	.8101
33	726	.7750	.8374
34	727	.8230	.8615
35	728	.8350	.8825
36	729	.8882	.9007
37	730	.8949	.9163

Appendix F.1. Environmental measurements and observations made in Upper Cook Inlet, 1991, Alaska during the offshore test fishing project.

Date	Station	Air Temp (c)	Water Temp (c)	Wind Vel (knots)	Wind Dir ^a	Tide Stage ^b	Water Depth (f)	Secchi (m)
01 July	4	8	8.5	6	5	3	25.5	6.0
	5	10	10.0	3	5	2	38.5	2.5
	6	11	10.0	8	5	4	45.5	3.0
	7	11	10.0	10	6	4	45.5	3.0
	8	10	10.0	10	6	4	29.5	1.5
02 July	7	9	10.0	3	5	4	46.5	3.5
	6	9	9.0	5	4	3	46.5	3.0
	5	10	9.0	1	4	3	38.0	4.5
	4	11	8.0	3	4	3	25.0	9.0
03 July	4	10	9.0	15	5	3	24.5	8.0
	5	12	10.0	17	5	3	35.5	3.0
	6	13	10.0	20	5	3	46.5	2.5
	7	10	10.0	19	5	3	45.0	2.0
	8	11	11.0	18	5	2	30.0	2.0
04 July	8	8	10.0	16	4	4	29.0	2.0
	7	9	10.0	15	4	4	46.0	3.0
	6	8	10.0	17	4	4	47.0	3.0
	5	9	9.5	19	5	1	38.0	3.5
	4	9	8.5	17	5	1	26.0	4.0
05 July	4	10	9.0	1	6	1	26.5	7.0
	5	10	10.0	8	6	3	37.0	3.0
	6	11	11.0	4	6	3	48.0	3.0
	7	10	10.0	8	6	3	44.0	3.0
	8	12	10.0	2	6	3	29.5	3.0
06 July	8	10	11.0	0	0	3	29.5	2.0
	7	11	10.0	1	1	2	45.0	3.0
	6	10	10.0	2	1	4	47.0	4.0
	5	10	10.0	3	1	4	39.0	6.0
	4	10	10.0	2	2	4	26.0	11.5
07 July	4	10	8.0	0	0	4	27.0	11.0
	5	11	8.5	0	0	4	37.5	8.0
	6	13	9.0	0	0	4	50.0	3.5
	7	14	9.5	1	6	1	46.0	3.0
	8	12	9.0	3	5	3	30.0	3.0
08 July	8	9	9.0	10	4	3	29.0	3.0
	7	9	9.5	12	4	3	45.0	3.5
	6	9	10.0	10	4	3	44.0	2.5
	5	9	8.0	10	4	2	37.0	5.0
	4	9	8.0	7	5	4	27.0	6.0

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Appendix F.1. (p 2 of 4)

Date	Station	Air Temp (c)	Water Temp (c)	Wind Vel (knots)	Wind Dir ^a	Tide Stage ^b	Water Depth (f)	Secchi (m)
09 July	4	9	9.0	13	2	4	26.0	8.0
	5	9	9.0	10	1	4	38.0	10.0
	6	11	8.0	7	1	4	49.0	6.0
	7	10	10.0	5	5	4	45.0	3.0
	8	11	9.0	5	6	1	27.0	3.5
10 July	8	9	10.0	11	5	3	29.0	3.5
	7	9	10.0	13	5	3	43.5	4.0
	6	9	10.0	9	5	3	45.0	2.5
	5	10	8.5	6	5	3	38.5	6.0
	4	10	11.0	0	0	2	25.5	5.0
11 July	4	9	11.0	0	0	2	27.0	8.0
	5	13	8.0	0	0	4	37.5	6.5
	6	11	8.5	5	2	4	47.0	5.0
	7	10	9.0	0	0	4	47.0	3.5
	8	11	9.0	1	8	3	29.0	2.0
12 July	8	10	9.0	0	0	3	31.5	3.5
	7	9	9.0	3	5	3	45.0	3.0
	6	9	10.0	0	0	3	46.5	3.0
	5	9	8.5	0	0	3	40.0	4.0
	4	10	9.0	0	0	2	25.0	5.0
13 July	4	10	9.0	5	5	3	25.0	4.0
	5	10	10.0	12	6	3	40.0	4.0
	6	10	9.0	7	5	4	48.0	2.5
	7	10	10.0	9	6	4	50.0	4.0
	8	11	9.0	8	4	4	28.0	3.0
14 July	8	9	10.0	9	5	4	28.0	2.0
	7	10	9.0	8	4	1	51.0	3.0
	6	10	10.0	11	5	3	45.0	3.0
	5	11	9.0	7	5	3	35.0	4.5
	4	11	8.0	7	5	3	26.0	6.0
15 July	4	12	8.0	6	4	3	24.0	7.0
	5	13	10.0	7	4	3	36.0	3.5
	6	14	11.0	4	4	3	45.0	2.5
	7	13	11.0	6	6	4	43.5	2.0
	8	11	10.0	3	4	4	26.0	3.0
16 July	8	9	10.0	5	2	4	31.0	3.0
	7	10	10.0	6	2	3	46.0	3.5
	6	9	10.0	2	2	3	49.0	3.0
	5	10	9.0	3	2	3	41.0	4.0
	4	9	9.0	2	2	3	26.0	6.0
17 July	4	9	9.0	10	5	1	26.0	6.5

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Appendix F.1. (p. 3 of 4)

Date	Station	Air Temp (c)	Water Temp (c)	Wind Vel (knots)	Wind Dir ^a	Tide Stage ^b	Water Depth (f)	Secchi (m)
17 July	5	9	9.0	12	6	3	38.0	4.0
	6	10	10.0	17	6	3	48.0	3.0
	7	11	10.0	16	5	2	45.0	3.0
	8	13	10.0	18	4	4	25.0	1.5
18 July	8	10	11.0	5	1	4	32.0	2.0
	7	12	10.0	3	1	4	46.0	3.0
	6	11	10.0	4	1	1	45.0	3.0
	5	10	10.0	10	6	3	44.0	3.5
19 July	4	10	9.0	10	6	3	26.0	5.5
	4	11	9.0	7	5	4	28.0	5.5
	5	14	11.0	0	0	1	38.0	4.0
	6	15	10.0	0	0	3	49.0	3.0
20 July	7	14	10.0	0	0	3	45.0	3.5
	8	12	10.0	2	4	3	28.0	3.0
	8	10	10.0	0	0	4	27.0	3.0
	7	11	11.0	0	0	4	43.0	2.5
21 July	6	11	10.5	1	8	4	43.0	3.0
	5	11	10.0	4	4	4	37.0	4.0
	4	10	9.0	3	4	4	28.0	4.5
	4	11	9.0	0	0	4	28.0	6.5
22 July	5	13	10.0	0	0	4	33.0	5.0
	6	15	11.0	0	0	4	50.0	2.5
	7	14	12.0	1	7	3	44.0	3.0
	8	16	11.0	0	0	3	30.0	3.0
23-Jul	8	11	11.0	0	0	3	30.0	3.0
	7	13	11.5	2	5	4	45.0	2.5
	6	13	11.5	5	6	4	45.0	3.0
	5	11	10.0	0	0	4	37.0	5.0
24 July	4	13	9.0	0	0	4	27.0	6.0
	4	9	9.0	18	8	4	25.0	4.5
	5	10	10.0	13	1	4	46.0	4.5
	6	12	11.0	15	1	4	47.0	4.0
25 July	7	13	11.0	12	2	4	46.0	3.0
	8	14	11.5	13	2	4	28.0	2.5
	8	10	11.5	12	8	3	31.0	3.5
	7	11	11.5	18	1	3	45.0	3.5
	6	11	11.0	19	2	3	45.0	4.0
	5	10	10.0	23	8	2	37.0	4.0
	4	10	11.0	20	8	4	28.0	5.5
	4	14	10.0	0	0	3	25.0	7.0
	5	13	10.0	0	0	2	42.0	7.5

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Appendix F.1. (p 4 of 4)

Date	Station	Air Temp (c)	Water Temp (c)	Wind Vel (knots)	Wind Dir ^a	Tide Stage ^b	Water Depth (f)	Secchi (m)
25 July	6	13	10.0	0	0	4	47.0	5.0
	7	15	10.0	0	0	4	45.0	3.5
	8	13	11.0	0	0	4	32.0	3.0
26 July	8	10	11.0	4	5	3	29.5	3.0
	7	12	11.0	7	4	3	42.5	3.0
	6	12	11.0	8	4	3	46.0	3.0
	5	14	11.0	7	4	3	40.0	4.0
	4	14	10.0	0	0	2	28.5	10.0
27 July	4	13	9.0	7	4	3	24.5	6.5
	5	13	10.0	8	4	3	37.0	5.0
	6	17	11.0	4	4	2	46.0	3.5
	7	14	10.0	3	4	4	36.0	2.5
	8	13	11.5	4	4	4	26.0	2.5
28 July	8	13	10.0	2	5	3	31.0	3.0
	7	11	11.0	12	5	3	44.0	2.5
	6	13	11.0	15	5	3	46.0	3.5
29 July	4	13	9.0	15	6	3	25.0	6.5
	5	12	11.0	18	6	3	36.0	2.5
	6	13	11.5	18	6	4	46.0	2.5
	7	11	11.0	16	6	4	47.0	2.5
	8	10	11.0	11	6	4	31.0	2.5
30 July	8	9	11.0	4	1	1	27.0	3.0
	7	10	11.0	0	0	3	51.0	3.5
	6	9	10.0	0	0	3	47.0	3.5
	5	10	10.0	0	0	3	37.0	5.0
	4	10	10.0	0	0	3	26.0	8.0

^a Wind direction code 1=north,2=northeast,3=east,4=southeast,
5=south,6=southwest,7=west,8=northwest

^b Tide stage code 1=high,2=low,3=ebb,4=flood